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David Cassano

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Cassano, David, "DETECTING AUDIBLE INDICATORS OF MEDICAL SYMPTOMS", Technical Disclosure Commons, (March 10, 2015)

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DETECTING AUDIBLE INDICATORS OF MEDICAL SYMPTOMS

BACKGROUND

[0001] The present disclosure generally relates to monitoring the health of individuals by analyzing audio signals. More specifically, the present disclosure relates to using pattern recognition of various audible indicators to diagnose possible illnesses.

[0002] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

[0003] Various types of audio monitoring devices and the like are occasionally disposed throughout buildings, including homes and offices. Traditionally, the use of these devices has primarily related to safety and security concerns, such as nanny cams, baby monitors, home security systems, etc. However, audio monitoring devices could also be used to monitor individuals for health issues. As a result, the ability to utilize audio monitoring devices in health applications may be highly desirable.

SUMMARY

[0004] A summary of certain embodiments disclosed herein is set forth below. It should be understood that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

[0005] This disclosure relates to systems and methods for monitoring the health of individuals by measuring the audible intensity and frequency of biological noises and other audible emissions, such as coughing, sneezing, sniffles, flatulence, vomiting,

burping, hiccups, labored breathing, other audible indicators of medical symptoms, or any combination thereof. In one example, pattern recognition techniques are used to diagnose possible illnesses (e.g., pollen allergy, pneumonia, etc.) by analyzing recorded audio data for indicators of illness. In certain embodiments, audio data that is recorded at a location (e.g., a house) that may be frequented by multiple individuals may use geographic cues (e.g., the audio monitoring device located in the master bedroom) to tie the data to an appropriate individual. Additionally, in certain embodiments, pattern recognition techniques, such as audio or facial recognition techniques, may be used to identify the specific individual. In certain embodiments, other visual recognition techniques may be used to identify visual symptoms (e.g., dilated pupils, excessive perspiration, etc.). Furthermore, in certain embodiments, illness trends may be tracked and factored into the illness analysis (e.g., seasonal allergies, flu epidemics, etc.).

[0006] Various refinements of the features noted above may exist in relation to various aspects of the present disclosure. Further features may also be incorporated in these various aspects as well. These refinements and additional features may exist individually or in any combination. For instance, various features discussed below in relation to one or more of the illustrated embodiments may be incorporated into any of the above-described aspects of the present disclosure alone or in any combination. The brief summary presented above is intended only to familiarize the reader with certain aspects and contexts of embodiments of the present disclosure without limitation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Various aspects of this disclosure may be better understood upon reading the following detailed description and upon reference to the drawing in which:

[0008] FIG. 1 illustrates an audio detection system in a building environment, in accordance with an embodiment; and

[0009] FIG. 2 illustrates various waveforms of audible indicators of illness.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0010] Embodiments of the present disclosure relate to an audio monitoring device, such as a baby monitor or nanny cam, that may sense or record audio input from nearby individuals. The audible intensity and frequency of biological noises and other audible emissions, such as coughing, sneezing, sniffles, flatulence, vomiting, burping, hiccups, labored breathing, other audible indicators of medical symptoms, or any combination thereof, may be measured and analyzed. In one example, pattern recognition techniques are used to diagnose possible illnesses (e.g., pollen allergy, pneumonia, etc.) by analyzing the recorded audio data and identifying indicators of various illnesses.

[0011] By way of introduction, FIG. 1 illustrates an audio detection system in a building environment, in accordance with an embodiment. The individual 10 makes a noise, such as a cough, which is detected by an audio monitoring device 24. The audio monitoring device 24 may be any device that can sense audio disturbances and/or other sounds, such as a baby monitor, nanny cam, etc. In the illustrated embodiment, audio monitoring device 24 includes a network interface that may connect audio monitoring device 24 to a home network 20. Audio monitoring device 24 may connect to the home network 20 wirelessly or through a wired connection. In alternative embodiments, audio monitoring device 24 may not have a network interface, and instead may be connected to a computing device, such as laptop 28 which may connect to home network 20. In some embodiments, software may be installed on computing or mobile devices, such as laptop 28 or smartphone/tablet 22, such that the software may enable the computing or mobile devices to perform the same functions as audio monitoring device 24. It is appreciated that audio monitoring device 24 can be any electronic device that has at least one audio sensor that can detect sounds. Home network 20 is connected to the internet 30.

[0012] In some embodiments, a building may have a number of separate individuals that are producing noises that are detected by audio monitoring device 24. For example, if audio monitoring device 24 is placed in a high-traffic common room, such as a living room, it may pick up audio data from more than one occupant. Audio monitoring device

24 may be able to preset the identity of individuals during a setup process, for example, by having each individual provide audio samples. Individuals may then be recognized through noises made by using audio recognition techniques. Audio monitoring device 24 may also be able to prompt an individuals for their identities when it detects an audible indicator of illness. For example, when audio monitoring device 24 detects a cough, it may ask individuals for the identity of the cougher. In some embodiments, audio monitoring device 24 may use geographic cues to tie an audio sample to a specific individual 10 (e.g., the audio monitoring device 24 is located in the master bedroom). Other technologies may be combined to determine the identity of the individual 10. For example, data gathered from video monitoring device 26 simultaneously with the data from audio monitoring device 24 may be used by facial recognition software to identify the specific individual 10.

[0013] Audio monitoring device 24 may record the noise and send the audio data, through home network 20 and internet 30, to a server 32. Data compression may be used to modify the audio data such that less data is required to be sent to server 32. Alternatively, audio monitoring device 24 may analyze the noise in real-time and only send relevant audible indicators of illness to server 32.

[0014] Server 32 may be configured to perform audio analysis on the received audio data. Server 32 may also store a library of audible indicators of illness, such as those shown in FIG. 2. In some embodiments, server 32 uses pattern recognition techniques to analyze the recorded audio data sent from an audio monitoring device 24, a computing device 28, a mobile device 22, or any combination thereof, for indicators of illness. In alternative embodiments, software installed on the audio monitoring device 24, the computing device 28, the mobile device 22, or any combination thereof, perform the pattern recognition techniques to analyze the recorded audio data for indicators of illness.

[0015] In some embodiments, the audio data analysis may be combined with visual data analysis, for example, provided by video monitoring device 26, mobile device 22, computing device 28, or any combination thereof. The visual data analysis may include

facial recognition techniques that may recognize indications of illness (e.g., dilated pupils, facial contortions during cough or sneeze, bags under eyes, excessive perspiration, etc.) or movement detection that may recognize indications of illness (e.g., wiping/blowing nose).

[0016] Possible illness diagnoses may then be communicated from the server 32 through the internet 30 and the home network 20 to the individual 10 through the mobile device 22, computing device 28, or any combination thereof. It is appreciated that communication to the individual may be provided through any electronic device connect to a network, such as home network 20 or internet 30.

[0017] It is appreciated that it may be desirable to include user privacy or other information security features to the disclosed systems and methods. Thus, certain embodiments may include anonymization of data, such as ensuring that personally-identifiable information is not tied to the recorded audio data or transmitted audible indicators of illness. Users may be able to select privacy options or levels of privacy to match their needs. Information gathered by the audio monitoring device 24 or analyzed and transmitted by the server 32 may only be accessed by users with the proper security credentials. Some embodiments may include the ability to tailor access restrictions, log access violations, log access of the relevant information, purge the aforementioned logs, or any combination thereof.

[0018] In some embodiments, the audible indicators of illness may be stored such that they may be used to determine if an illness is intensifying, receding, staying constant, etc. Advantageously, small changes in health that often go unnoticed until severity has increased will be tracked and the resultant data can be used for more accurate diagnoses. Some embodiments may be able to access an individual's health records such that a more accurate diagnose can be realized. Such embodiments may include the ability to recognize high-risk situations as a result of having the benefit of knowledge of the individual's medical history and could alert the individual or emergency services in those

situations. Such embodiments may also be able to automatically schedule doctor's appointments or visits by health care professional based on certain identified symptoms.

[0019] Some embodiments may have the ability to suggest remedies based on the possible illness. For example, prescription or non-prescription products may be suggested, such as tissues, cough syrup, aspirin, cold/flu medication, antacids, anti-histamines, etc. Embodiments may also recommend changes in diet, for example, based on evidence of burping, flatulence, vomiting, etc.

[0020] In certain embodiments, illness trends may be tracked and factored into the diagnosis (e.g., seasonal allergies, flu epidemics, etc.). Moreover, weather and/or environment information, such as health severity levels (e.g., air pollution, pollen count, etc.), may also be tracked and/or factored into the diagnosis. Additional location technologies, such as GPS, WiFi triangulation, BLE proximity, etc., may be used to infer high risk locations and/or environments (e.g., public transit, airlines, etc.) for high risk individuals (e.g., individuals afflicted with immune diseases, transplant patients, etc.). The ability to track audible indications of illness could scale up to provide multiple levels of analysis, including at individual, community, region, state, or global levels. Advantageously, the ability to aggregate health symptom data over different geographic levels may help to identify pandemics, predict the spread of diseases, deploy treatment strategies, evaluate effectiveness of treatment strategies, determine increases and decreases in disease levels, etc. Furthermore, geographical knowledge may help to identify whether nearby industrial hazards (e.g., housing near an oil refinery or toxic waste site) could be negatively impacting the individual.

[0021] It is envisioned that embodiments of the present disclosure may be particularly useful in hospitals, health care facilities, or home healthcare environments. It is recognized that there may be specific rooms in specific buildings where it may be particularly useful to place such embodiments due to the likelihood of detecting audible indicators of illness (e.g., bathrooms in the case of vomiting).

[0022] Additionally, embodiments are not necessarily limited to humans. For example, audible health indicators may be used to determine whether antibiotic treatments on livestock should be increased or decreased. Additionally, outbreaks or trends of diseases related to animals (e.g., swine flu, bird flu, etc.) may be recognized earlier and allow for early treatment or the need for isolation/quarantine.

[0023] The specific embodiments described above have been shown by way of example, and it should be understood that these embodiments may be susceptible to various modifications and alternative forms. It should be further understood that the claims are not intended to be limited to the particular forms disclosed, but rather to cover all modifications, equivalents, and alternatives falling within the spirit and scope of this disclosure.

ABSTRACT OF THE DISCLOSURE

[0001] This disclosure relates to systems and methods for monitoring the health of individuals by measuring the audible intensity and frequency of biological noises and other audible emissions, such as coughing, sneezing, sniffles, flatulence, vomiting, burping, hiccups, labored breathing, other audible indicators of medical symptoms, or any combination thereof. In one example, pattern recognition techniques are used to diagnose possible illnesses (e.g., pollen allergy, pneumonia, etc.) by analyzing recorded audio data for indicators of illness.

Fig. 1

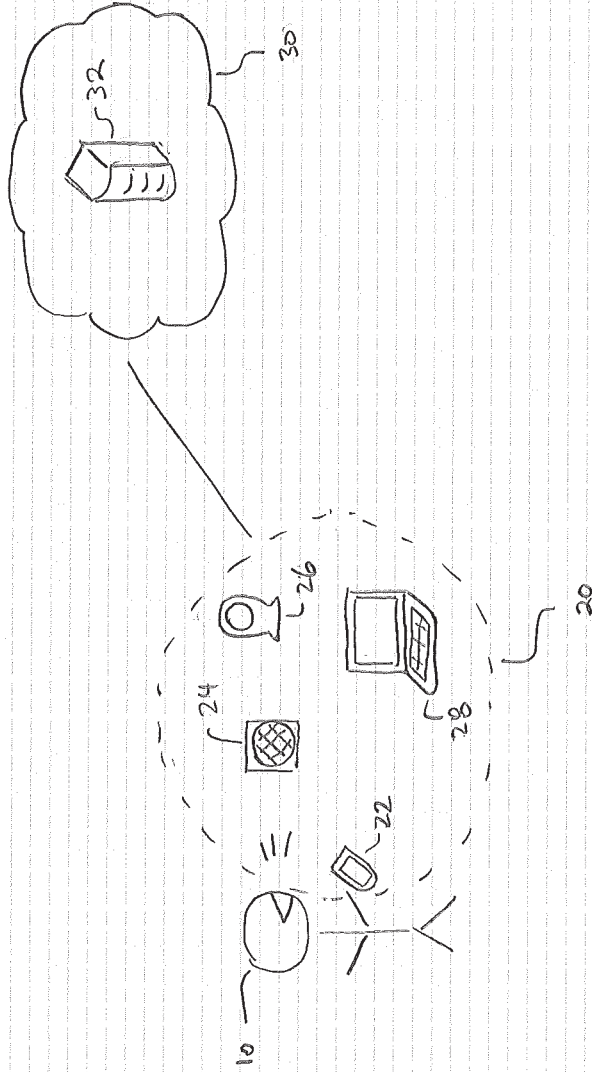


Figure 2

